AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims:

1. (Currently amended) An acoustic telemetry apparatus for communicating digital data from a down-hole location through a borehole to the surface comprising:

an acoustic channel terminated at a down-hole end by a reflecting terminal;

an acoustic wave generator located at the surface and providing an acoustic wave carrier signal within said acoustic channel;

a modulator located at said down-hole location and adapted to modulate amplitude and/or phase of said carrier wave in response to a digital signal; and

one or more sensors located at the surface adapted to detect amplitude and/or phase related information of acoustic waves traveling within said acoustic channel;

wherein the modulator and the reflecting terminal form a phase shifting reflector for the carrier wave, switchable between a first state which reflects the carrier wave and a second state which reflects the carrier wave with a shift in phase relative to reflection by said first state.

2 to 4 (Cancelled)

5. (Currently amended) The apparatus of ~~claim 4~~ claim 1 wherein the modulator switches between a first state that causes the phase of an acoustic wave reflected at said terminal to invert and a second state that maintains the original phase of the incident wave.

6. (Original) The apparatus of claim 1 wherein the acoustic channel is a column of liquid extending from the surface to a down-hole location.

7. (Original) The apparatus of claim 6 wherein the acoustic channel is formed by filling an annular volume in the borehole with a liquid.

8. (Original) The apparatus of claim 6 wherein the acoustic channel is formed by filling a tubing string suspended in the borehole with a liquid.

9. (Original) The apparatus of claim 6 wherein the column of liquid has a viscosity of less than 3×10^{-3} NS/m^2.

10. (Original) The apparatus of claim 1 wherein the modulator is a resonator located in the vicinity of the reflecting terminal point.

11. (Original) The apparatus of claim 10 wherein the resonator comprises a liquid filled volume enclosed in a housing having a tubular opening to the reflecting terminal.

12. (Original) The apparatus of claim 11 wherein the resonator has two or more tubular openings to the reflecting terminal.

13. (Original) The apparatus of claim 11 wherein the acoustic wave generator is adapted to simultaneously generate acoustic waves at different frequencies.

14. (Original) The apparatus of claim 1 further comprising an acoustic receiver in a down-hole location adapted to receive acoustic channel in a down-hole location.

15. (Original) The apparatus of claim 1 wherein the digital data is encoded digital data.

16. (Currently amended) The apparatus of claim 1 wherein the sensors are connected to a decoding unit adapted to convert detected ~~amplitude and/or~~ phase related information into a digital signal.

17. (Original) The apparatus of claim 1 wherein the sensors are connected to a signal processing unit adapted to filter the carrier wave signal from detected information.

18. (Original) The apparatus of claim 1 wherein the modulator comprises a piezoelectric actuator.

19. (Original) The apparatus of claim 1 comprising a down-hole power generator adapted to convert acoustic energy from an acoustic wave signal generated at the surface.

20. (Original) Use of the apparatus of claim 1 in a well stimulation operation.

21. (Currently amended) A method of communicating digital data from a down-hole location through a borehole to the surface comprising the steps of:

establishing an acoustic channel through said borehole and terminating said acoustic channel at a down-hole end by a reflecting terminal;

generating from the surface an acoustic wave carrier signal within said acoustic channel;

modulating ~~amplitude and/or~~ phase of said carrier wave in response to a digital signal by switching the modulator and the reflecting terminal between a first state which reflects the carrier wave and a second state which reflects the carrier wave with a shift in phase relative to reflection by said first state; and

detecting at the surface ~~amplitude and/or~~ phase related information of acoustic waves traveling within said acoustic channel.

22 and 23. (Cancelled)

24. (Original) The method of claim 21 further comprising the step of placing a Helmholtz resonator in proximity to the reflecting terminal.

25. (Original) The method of claim 21 further comprising the steps of

performing measurements of down-hole parameters,

encoding said measurements into a bitstream; and

controlling the reflecting properties of the reflecting terminal in response to said encoded bitstream.

26. (Original) The method of claim 21 further comprising the step of

selecting the frequency of the carrier wave such that it is close to the resonance frequency of a resonator used to modulate said carrier wave.

27. (Original) The method of claim 21 further comprising the steps of

scanning through a range of possible carrier frequencies;

monitoring at the surface reflected and modulated wave signal;

selecting the frequency of the carrier wave such that the detection of said reflected and modulated wave signal is optimized; and

commencing the communication of down-hole measurements.

28. (Currently amended) A method of stimulating a wellbore comprising the steps of

performing operations designed to improve the production of said wellbore while simultaneously establishing an acoustic channel through said borehole and terminating said acoustic channel at a down-hole end by a reflecting terminal;

generating from the surface an acoustic wave carrier signal ~~through~~ within said acoustic channel;

modulating ~~amplitude and/or~~ phase of said carrier wave in response to a digital signal by switching the reflecting terminal between a first state which reflects the carrier wave and a second state which reflects the carrier wave with a shift in phase relative to reflection by said first state; and

detecting at the surface ~~amplitude and/or~~ phase related information of acoustic waves traveling within said acoustic channel.

29-33 (Canceled)

34. (Previously presented) The apparatus of claim 19, wherein the down-hole power generator is located within the annulus and comprises an electro-acoustic transducer adapted to convert the energy of the acoustic wave into electrical energy.

35. (Previously presented) The apparatus of claim 34, further comprising:

an energy storing capacitor adapted to store the electrical energy and provide power to one or more down-hole devices.

36. (New) The apparatus of claim 1 wherein the acoustic wave carrier signal is continuous.

37. (New) The apparatus of claim 10 wherein the resonance frequency of the resonator is close to a frequency of the acoustic wave carrier signal.

38. (New) The apparatus of claim 11 wherein the reflecting terminal is movable between positions which respectively open and close said housing to the acoustic channel, thereby switching between said first and second states.

39. (New) The method of claim 21 wherein the acoustic wave carrier signal is continuous.

40. (New) The method of claim 21 further comprising placing a Helmholtz resonator in proximity to the reflecting terminal, selecting a frequency of the acoustic carrier wave such that it is close to the resonance frequency of said resonator and switching the reflecting terminal between said first and second states by switching between positions which respectively open and close said resonator to the acoustic channel.

41. (New) The method of claim 28 wherein the acoustic wave carrier signal is continuous.

42. (New) The method of claim 28 further comprising placing a Helmholtz resonator in proximity to the reflecting terminal, selecting a frequency of the acoustic carrier wave such that it is close to the resonance frequency of said resonator and switching the reflecting terminal between said first and second states by switching between positions which respectively open and close said resonator to the acoustic channel.